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APPLICATIONS W MILLER ET AL. 17 FEB 86
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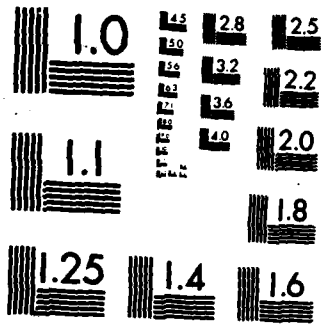

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This is the final technical report for an equipment grant which provided microcomputers in individual offices to be used as research tools by faculty in the School of Mathematics and participants in the programs of the Institute for Mathematics and Its Applications. Many research projects are underway; also mathematical software is being developed for use in the Dynamical Systems, Stochastic Modeling and Combinatorics Laboratories. The microcomputers will soon be linked by an Ethernet and are serving as terminals for access to the University's Cray 2 supercomputer.

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School of Mathematics
Institute for Mathematics and its Applications
University of Minnesota

Final Scientific Report
Grant AFOSR-85-0116

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Chief, Technical Information Division

Willard Miller, Jr.
Professor and Head
School of Mathematics
February 17, 1986

Willard Miller, Jr.

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The DoD-URIP Grant totals $100,000; in addition the University of Minnesota has provided $25,009 in cost sharing for this computer equipment grant. Of the total grant $87,009 was committed to the School of Mathematics and $38,000 was committed to the Institute for Mathematics and its Applications (IMA). The attached list details the expenditures for individual faculty members in the School of Mathematics and for the IMA.

The IMA funds were used primarily in the purchase of 11 MacIntosh Microcomputers (512K memory), 3 hard disk drives and 1 AT&T Personal Computer. The School of Mathematics has purchased 28 MacIntosh Microcomputers (512K memory) and 8 IBM Personal Computers together with accessories and software.

The IMA is using the grant to equip offices of individual researchers with microcomputers. This is part of an overall plan of the IMA to have state of the art computational facilities in place for the 1986-87 year on Scientific Computation which begins August 1986.

In the next few days the School of Mathematics and the Institute for Mathematics and its Applications will be linked to the University's Cray 2 Supercomputer via a fiber optic cable. Within the next few months an Ethernet will be established to link all faculty offices in the School of Mathematics and offices in the IMA. By June 1986 the University of Minnesota will have installed a new telecommunications system, designed for high speed data transmission. An important function of the microcomputers purchased under this grant will be to serve as terminals in the new telecommunications system, particularly for access to supercomputers.

The supercomputer access will be very important for number crunching, but perhaps even more important for the use of symbol manipulation programs. The School of Mathematics has hired Dr. Ronald Peikert of ETH, Zurich to implement a symbol manipulation program on the Cray 2.

Although all microcomputers purchased with this grant are being placed in individual researchers offices, several faculty members are using their machines to prepare software for three different high-level research and instructional labs for which the laboratory computer equipment is being provided by industrial donors. The first and oldest of these is the Dynamical Systems Laboratory, a research laboratory managed by Professors Aronson, McGehee and Moeckel, which is heavily oriented toward computer graphics and is partially supported by the National Science Foundation and CPT Corporation. We are in the process of establishing a Stochastic Modeling Laboratory, using equipment from the DOD grant and a grant from IBM Corporation. This laboratory will provide facilities for model testing and development. (Since the effects of randomness cannot be ignored in many physical, biological and technical processes, our researchers must be able to construct and analyze stochastic models. These are often highly complex and direct mathematical analysis is difficult or impossible. The SML will provide the tools for creating, testing and observing such systems. In industrial applications, the systems will be used to provide numerical predictions about the behavior of concrete physical processes. High quality visual representations will be an important part of the SML so that qualitative features of a model can be recognized. Research hypotheses can then be formed, tested and finally attacked theoretically.) The SML is being operated by

our probabilists: Professors Orey, Pruitt, Jain, Fristedt, Brannson and Baxter, and Associate Professor Gray.

Third, we are developing a Combinatorics Laboratory. It will be used to demonstrate combinatorial algorithms, bijections, and involutions. Software packages are being developed which will allow researchers to represent and manipulate combinatorial objects (graphs, permutations, partially ordered sets, integer partitions, tableaux, etc.). The software packages will make extensive use of graphics. It will be possible with these packages to test conjectures, ideas and possible constructions in combinatorics. This lab will be managed by Professors Dennis White and Dennis Stanton. IBM Corporation is providing additional equipment for the lab.

Individual faculty members are using microcomputers for their own personal projects. Among these are the following: Professor Albert Marden is working on problems in computational geometry. Professor Dennis Hejhal is using his microcomputer in the study of the dynamics of zeros of the Epstein zeta function. (Professors Marden and Hejhal have made a proposal to the National Science Foundation for a major grant that would involve the country's leading researchers in geometry and number theory and make use of the University of Minnesota's Cray 2 and satellite communications between the Cray 2 and individual researchers at their various locations. This proposal will go to the National Science Board for approval.) Professor Jay Goldman, a number theorist, is using his micro-computer and software developed by Enrico Bombieri of the Institute for Advanced Study to conduct research on continued fractions. Professor

Karel Prikry is working on a problem in applied logic. Professor William Messing, an algebraic geometer, will use his equipment to "experiment" with a structure of certain modules over finite fields as well as study certain "huge" polynomials. Professors Walter Littman and Larry Markus are developing software to study the stability of a space platform. Professor Yasutaka Sibuya will use his microcomputer with symbolic manipulation programs for his research in ordinary and functional differential equations. The plans of our individual faculty members for use of microcomputers in research projects are under rapid evolution and I am reporting only the few cases where I have personal information. However, it is already clear that this grant is having a considerable impact on the research of our faculty. Furthermore, the grant and the expertise gained by the faculty in the use of computers has enabled the School of Mathematics to compete successfully for other computer grants, most notably for Apollo Workstations and IBM AT's.

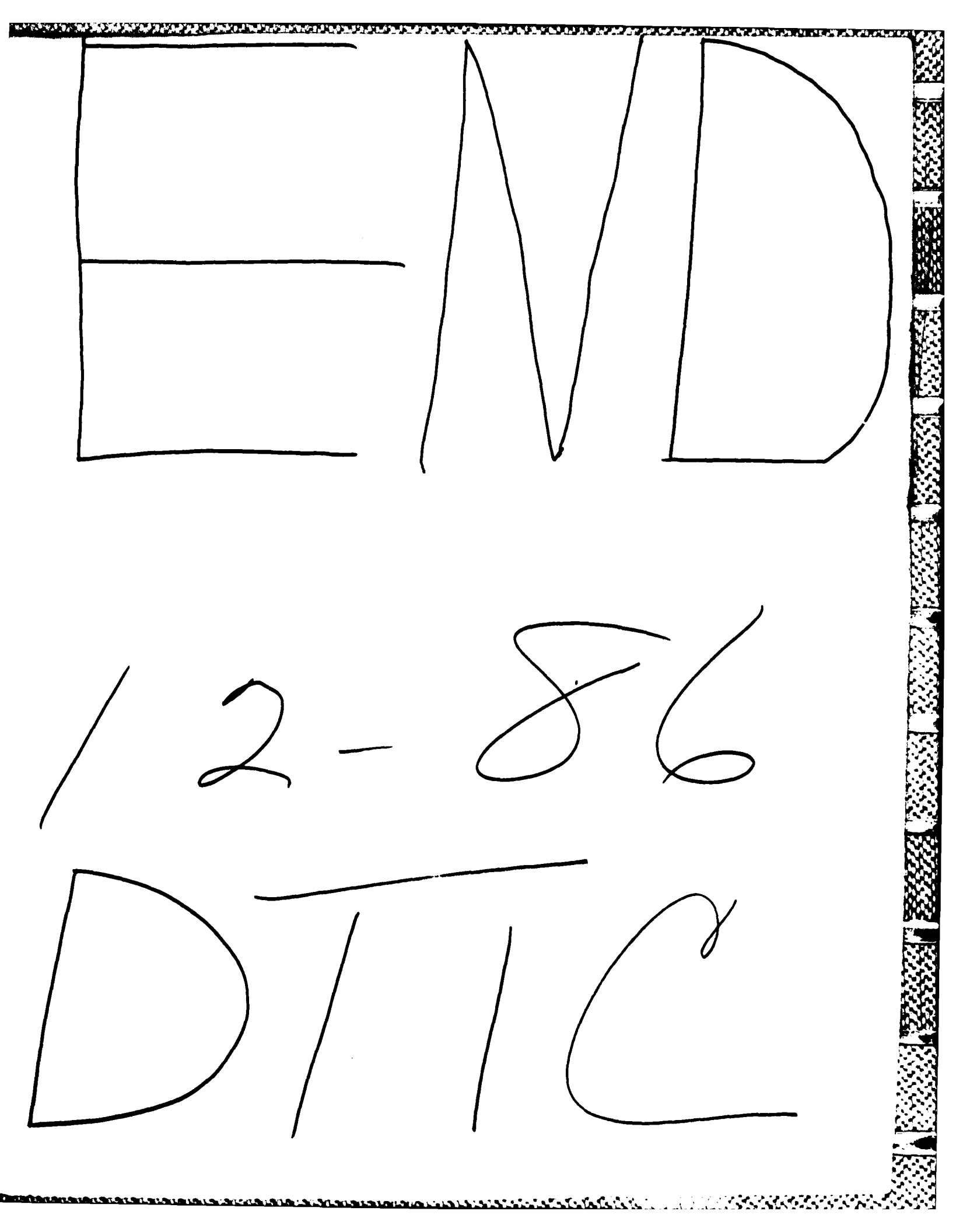
2/17/86 COMPUTER EQUIPMENT GRANT

FACULTY	COMPUTER/COST	ACCESSORIES/COST	SOFTWARE/COST	TOTAL COST
ABARD	MAC	DISKS	PASCAL/BASIC	
	$2,155.00	$31.00	$158.00	$2,344.00
ARONSON	AMDEK MONITOR/AST 6-PACK HERCULES GRAPHICS BOARD IBM PC - MATH CO-PROC.CHIP	HERCULES COLOR BOARD		
	$2,407.78	$192.00		$2,599.78
BARRETT	MAC	DISKS	PASCAL	
	$2,155.00	$139.75	$80.00	$2,374.75
GILDELAMADRID	MAC	DISKS	PASCAL/BASIC	
	$2,155.00	$31.00	$158.00	$2,344.00
GREEN	MAC			
	$2,055.00			$2,055.00
GOLDMAN	MAC	DISKS/CASE/STAND	PASCAL/BASIC	
	$2,155.00	$130.00	$158.00	$2,443.00
GULLIVER	MAC	DISKS	MACFORTRAN/PASCAL	
	$2,155.00	$31.00	$280.00	$2,466.00
HARRIS	MAC	DISKS	PASCAL/BASIC	
	$2,470.00	$31.00	$158.00	$2,659.00
HARDT	MAC	DISKS/STAND	PASCAL/BASIC	
	$2,155.00	$61.00	$158.00	$2,374.00
HEJHAL	IBM PC-XT/EPSON PRINTER MATH CO-PROCESSOR CHIP 45 64K RAM CHIPS			
	$3,862.00			$3,862.00
KINDERLEHRER	MAC	DISKS		
	$2,155.00	$31.00		$2,186.00
LANG	MAC	DISKS	PASCAL/BASIC	
	$2,155.00	$31.00	$158.00	$2,344.00
LOUD	AMDEK MONITOR/AST 6-PACK HERCULES GRAPHICS BOARD IBM PC - MATH CO-PROC.CHIP	DISKS		
	$2,407.78	$13.50		$2,421.28
MCGEHEE	AMDEK MONITOR/AST 6-PACK HERCULES GRAPHICS BOARD IBM PC - MATH CO-PROC.CHIP			
	$2,407.78			$2,407.78
MESSING	MAC	DISKS/CASE/STAND	FACTFINDER/PASCAL/BASIC	
	$2,155.00	$130.00	$248.00	$2,533.00

HOECKEL	AMDEK MONITOR/AST 6-PACK HERCULES GRAPHICS BOARD IBM PC - MATH CO-PROC.CHIP $2,407.78			$2,407.78
HU	MAC $2,155.00	DISKS/CASE $100.00	PASCAL/BASIC $158.00	$2,413.00
HUTSCHE	MAC W/NUMERIC KEYBOARD $2,224.00	DISKS/STAND $61.00	PASCAL/BASIC/MACFORTRAN $383.00	$2,668.00
OLVER	MAC W/NUMERIC KEYBOARD $2,224.00	DISKS $31.00	PASCAL/BASIC $158.00	$2,413.00
POUR-EL	MAC $2,155.00	DISKS $31.00	PASCAL/BASIC/MACFORTRAN $383.00	$2,569.00
PRIKRY	IBM-IT/IBM GRAPHICS PRINTER MATH CO-PROCESSOR CHIP $3,231.00			$3,231.00
PROBABILITY	MACS (6) $12,500.00	DISKS (6) $186.00		$12,686.00
REICH	MAC $2,030.00		PASCAL/BASIC $158.00	$2,188.00
ROBERTS	MAC $2,155.00	DISKS $31.00	PASCAL/BASIC $158.00	$2,344.00
SATTINGER	MAC $2,155.00	DISKS $31.00		$2,186.00
SIBUYA/LITTMAN	AMDEK MONITOR/AST 6-PACK HERCULES GRAPHICS BOARD IBM PC EPSON FX-80 PRINTER/CABLE $2,596.78	DISKS $13.50	TRIAD/MULTIPLAN $598.00	$3,208.28
SPERBER	MAC $2,155.00	DISKS/CASE/STAND $130.00	FACTFINDER/PASCAL/BASIC $248.00	$2,533.00
STANTON	MAC $2,292.28	DISKS/PAPER $53.05	PASCAL $80.00	$2,425.33
TRIANTAFILLOU	MAC $2,310.00	DISKS $31.00	PASCAL/BASIC $158.00	$2,499.00
WEBSTER	MAC $2,155.00	DISKS $31.00	BASIC/MACFORTRAN/PASCAL $383.00	$2,569.00
TOTAL FACULTY $				$85,753.98

IMA	MACS (5)	$10,775.00	DISKS (5 BOXES)	
	MODEM (1)	$349.00		
	MACS (5)	$10,775.00	DISKS (5 BOXES)	
	AT&T PC6300 (HARD DSK DRIVE) (2)	$5,400.00		
	AT&T PC6300 (1)	$1,810.00		
	AT&T NUMERIC COPROCESSORS (3)	$540.00		
	AT&T MEMORY EXPANSION BRDS. (3)	$720.00		
	AT&T MEMORY CHIPS (3)	$360.00		
	HARD DISK DRIVE-PARTIAL PAYMENT	$230.00		
	HARD DISKS FOR NICAT	$2,500.00		
		$33,459.00	$310.00	$33,769.00
DEPARTMENT	TURBO PASCAL (4)	$261.50		$261.50
	TURBO TOOLBOX (1)	$46.50		$46.50
	SIDEKICK (1)	$46.50		$46.50
	MODEMS (2)	$698.00		$698.00
	MACTERMINALS (2)	$126.00		$126.00
	MACSECURITY KITS (5)	$135.00		$135.00
	QUICKSOFT MANUALS (6)	$117.00		$117.00
	EPSON FX-80 PRINTER/CABLE	$359.00		$359.00
	IBM TURBO TUTOR (3)	$75.00		$75.00
	TURBO GRAPHICS TOOLBOX (2)	$90.00		$90.00
	TURBO TOOLBOX (1)	$45.00		$45.00
	DISK CONTROLLER CARD	$66.00		$66.00
	RAM CHIPS (64K) FOR IBM PC (600)	$534.00		$534.00
	MACINTOSH FOR LAB	$2,000.00		$2,000.00
	PARTIAL PAYMENT FOR IBM PC	$886.52		$886.52
TOTAL DEPT. $				$5,486.02

MATH FACULTY EXPENDITURES	$85,753.98
MATH DEPT. EXPENDITURES	$5,486.02
MATH DEPT. TOTAL	$91,240.00
MATH DEPT. SHARE	$87,009.00
REMAINING FUNDS	$0.00
BORROWED FROM IMA FUNDS	$4,231.00
IMA SHARE	$38,000.00
IMA EXPENDITURES	$33,769.00
REMAINING IMA SHARE	$4,231.00
TOTAL EXPENDITURES	$125,009.00
DOD AWARD	$100,000.00
MATCHING FUNDS	$25,009.00
TOTAL FUNDS	$125,009.00
EXPENDITURES TO DATE	($125,009.00)
BALANCE - 2/17/86	$0.00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